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FOMES ANNOSUS Root Rot in the South

Guidelines for Prevention

Southern Forest Experiment Station
Southeastern Forest Experiment Station
and
Southeastern Area, State and Private Forestry,
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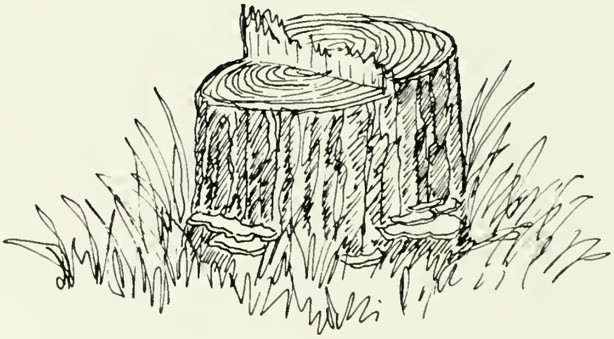

BY

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FOMES ANNOSUS – THE PROBLEM TODAY

Fomes annosus can cause root rot of most pine species in the South. Serious damage from the fungus was first observed in the late 1950's, after the thinning of pine plantations became widespread. *F. annosus* has not become a catastrophic problem Southwide but losses can be prohibitive on individual high hazard sites unless preventive steps are taken.

The impact of *F. annosus* on forest growth is difficult to assess because the fungus not only kills trees, but also causes an undetermined amount of growth loss from root decay. Even after *F. annosus* stops killing trees, losses continue into the future due to understocking of the stand. Because bark beetles are attracted to trees weakened by decay, *F. annosus* also may contribute to some bark beetle epidemics.

MEANS OF SPREAD – SPORES AND ROOT CONTACTS

F. annosus produces fruiting structures, or conks, which often are attached to the bark at the root collar area of the tree or stump. Spores from the undersurface of these conks are responsible for most long distance spread of the disease from one stand to another. The spores germinate readily on the surface of fresh stumps, producing mycelium that grows through the stump roots to roots of adjacent living trees. Tree-to-tree transmission is through root contacts. Spores may wash down through soil to penetrate roots directly; however, this doesn't seem to occur often because infections are uncommon in unthinned forests.

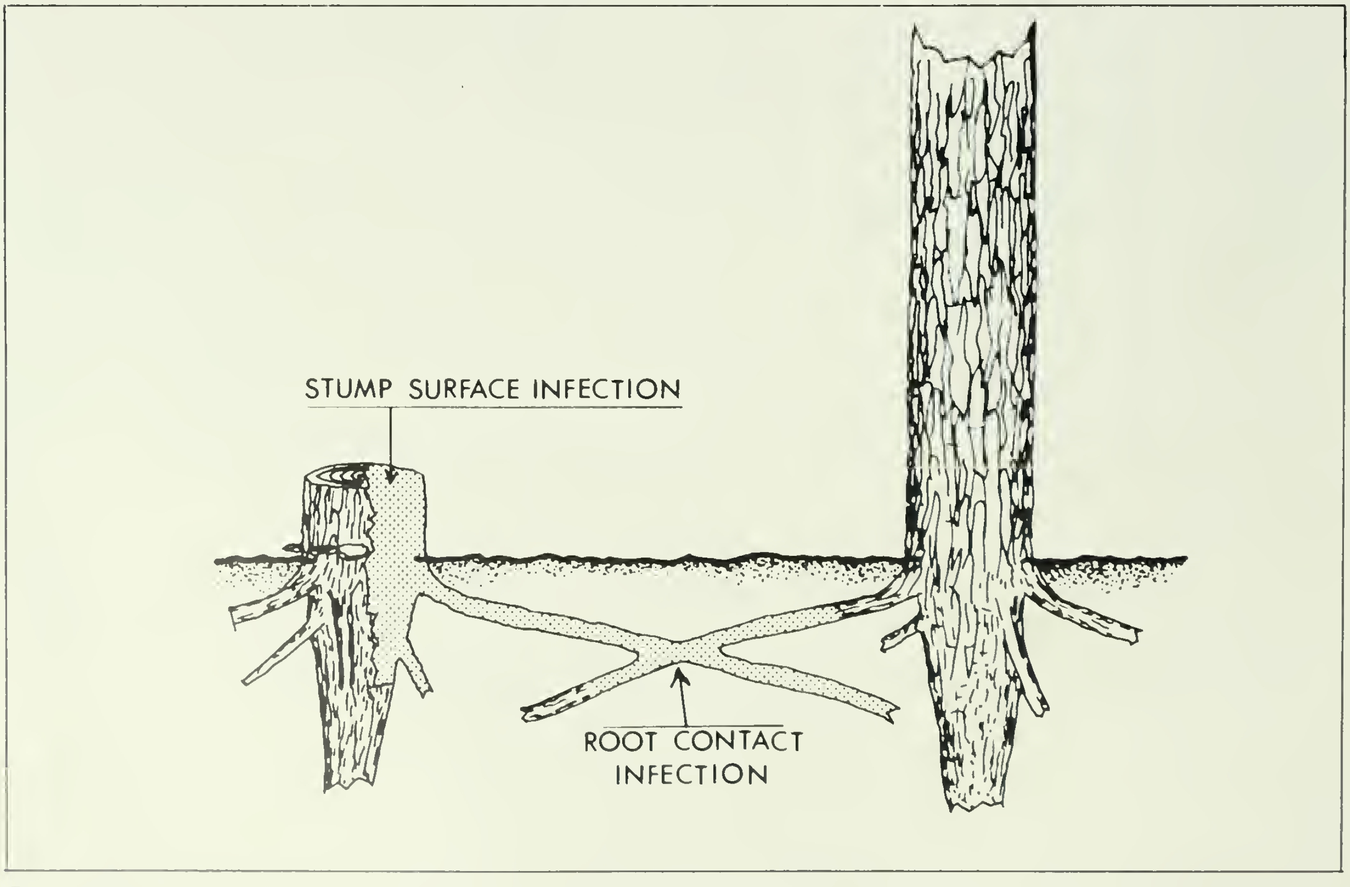


Figure 1.—Spores from conks on infected trees may travel long distances and land on freshly cut stumps. After landing on a stump, spores germinate and produce mycelium that grows through the stump roots to infect the roots of adjacent residual trees at points of root contact.

THE MAIN FACTOR – THINNING

The most important single factor in the infection of a pine stand is thinning. While fungus spores occasionally infect roots, most infections originate on the surface of freshly cut stumps. Plantations are much more heavily damaged than natural stands because of thinning at an early age and a continuity of roots that favor tree-to-tree spread of the fungus. However, when conditions are similar to those in many plantations, natural stands also may become heavily infected with root rot.

EARLY SYMPTOMS – DEAD AND DECLINING TREES

F. annosus should be strongly suspected as the cause of tree death when mortality begins the second or third year after thinning and continues for several years, creating gaps in the forest.

Some infected trees show signs of decline for one or more years before dying, with shortened needles and internodes, yellowish color, and often a heavy crop of cones. Other trees die quickly without any previous indication of disease.

Infected trees may show signs of decline – shortened needles, thin crowns, and yellow needles – before dying.

Group dying usually begins the second or third year after thinning and may continue for as long as 7 or more years on some sites.

THE KEY – EVALUATE SITE HAZARD BEFORE THINNING

Examine Thinned Plantations

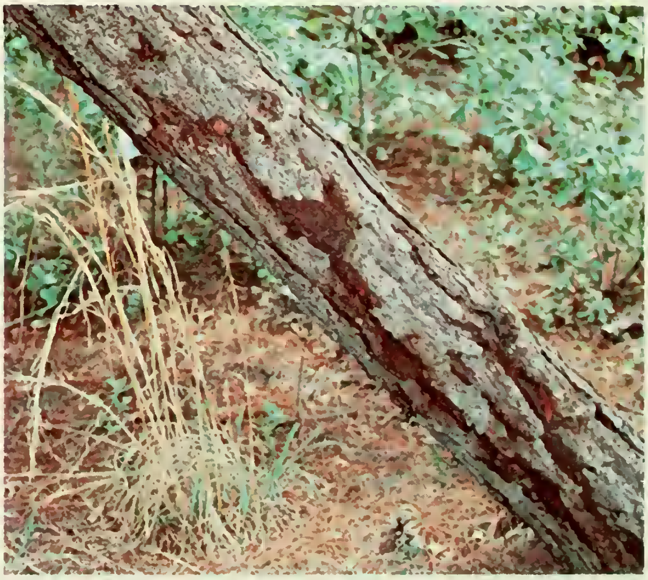
The number of diseased trees in previously thinned plantations will indicate whether the general area is low or high hazard to *F. annosus* and the need for preventive measures. Surveys should be conducted in plantations thinned 5 to 8 years previously. Don't survey plantations which were thinned in summer, because many stands escape infection when thinned during May through August.

Search for conks at the base of dead trees and stumps. Usually it is necessary to remove the litter to find conks, but they may not be present when litter is very light. Although perennial, conks often dry up and decay during hot dry summers, making them difficult to locate. The fruiting structures are usually about 2 inches across, but can be much smaller.

If further proof is needed, examine lateral roots facing a nearby, recently killed tree or a stump. Starting at the root collar, proceed outward looking for:

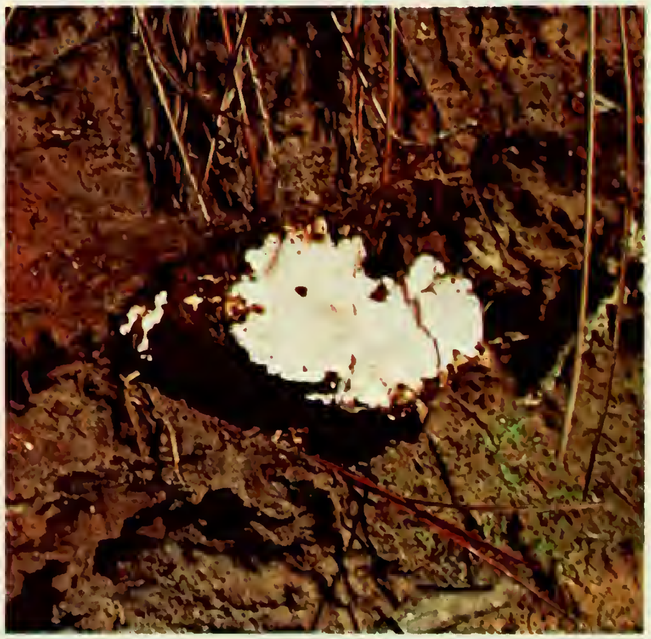
1. Pitch soaking of roots. Soil usually adheres to such roots as illustrated on page 5.
2. Terminal stringy root decay as shown on page 5.
3. Pustules (conks) about 1/8 inch in diameter. These may be snowy-white or tan, as illustrated on page 5.

Trees weakened by root decay die or are blown over by wind.

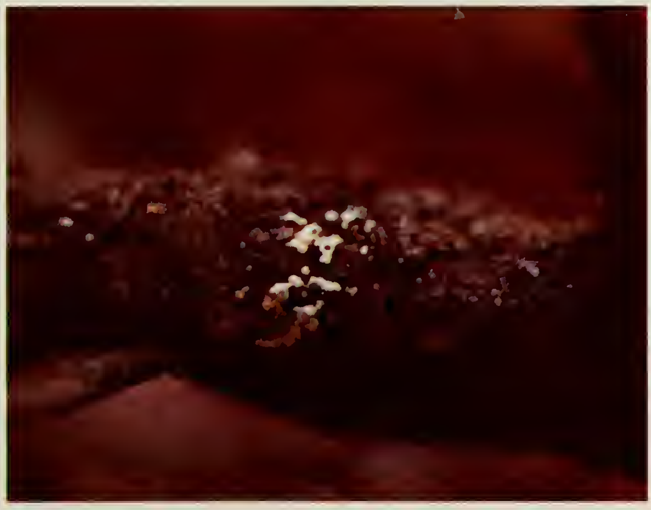


Trees killed by F. annosus *often look water-soaked due to excretion of resin.*

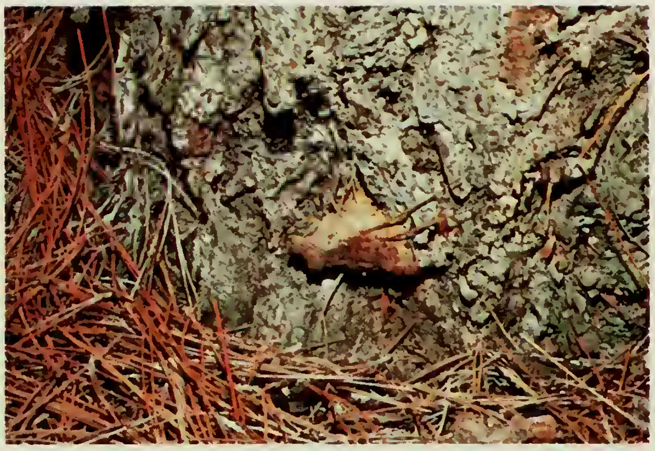
Search for conks below the litter at the base of dead trees and stumps.



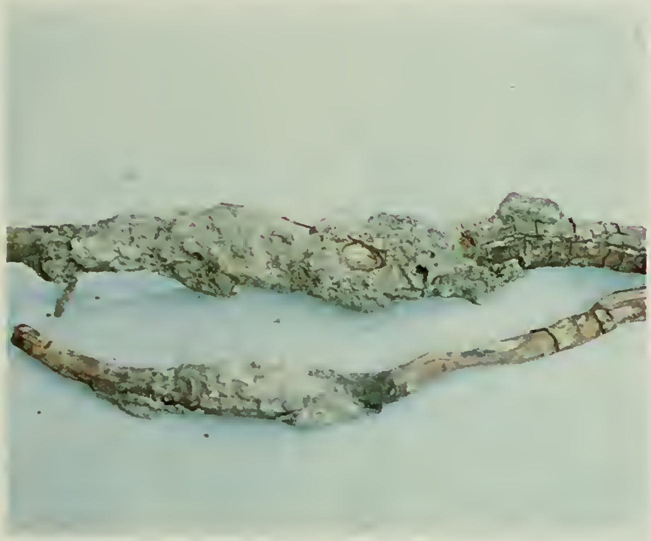
The lower surface of a conk often has an inactive (brown) and active (white) pore layer. The typical upper surface is brown with a distinct white margin.



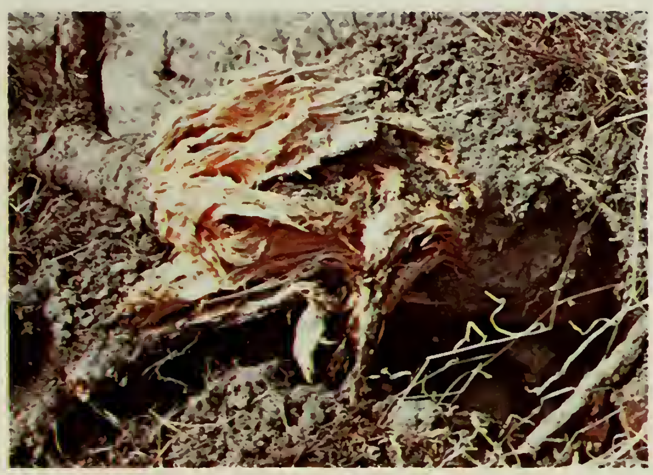
Small pustules (conks) often form on the surface of infected roots.



Polyporous tomentosus, *a fungus which can be confused with* F. annosus, *is associated with basal cankers caused by* Cronartium fusiforme *(fusiform rust).* F. annosus *conks can be distinguished from those of most other fungi by: (1) their color; (2) their leathery texture, making them difficult to tear apart; (3) small, uniformly shaped pores; and (4) absence of a stalk (stipe).*



Infected pitch-soaked roots often are black and soil usually adheres to them.



Stringy root decay caused by the fungus.

Conks also may be found in litter above infected roots, attached directly to roots, in cavities of windthrown trees, and on logging debris.

Examine the site

F. annosus does not become a serious problem in all plantations after thinning. Reasons for this have not been fully established, but soil factors seem to be the key. Although mortality is most frequent on former agricultural land, serious infections may occur in stands on previously undisturbed soil. It seems unlikely that intensive site preparation as now practiced will increase the hazard to *F. annosus.*

Low hazard sites.—Low hazard sites are those on which *F. annosus* is unlikely to be a problem.

The lowest hazard sites have poor internal soil drainage and high seasonal water tables. The best examples are the so-called "Flatwoods" of the Gulf or Atlantic Coastal Plain. The surface horizon often is only a few inches thick, and the underlying horizon tends to be grayish or yellowish. The land tends to be flat, and the subhorizons of soil are mottled due to a high water table. When moist, the subhorizons often have a plastic consistency.

A second type of low hazard site occurs on rolling terrain of the Coastal Plain or Piedmont where depth to clayey material is less than about 12 inches. In the Lower Coastal Plain, mottling may occur as on the flat, wet sites, because of poor internal drainage.

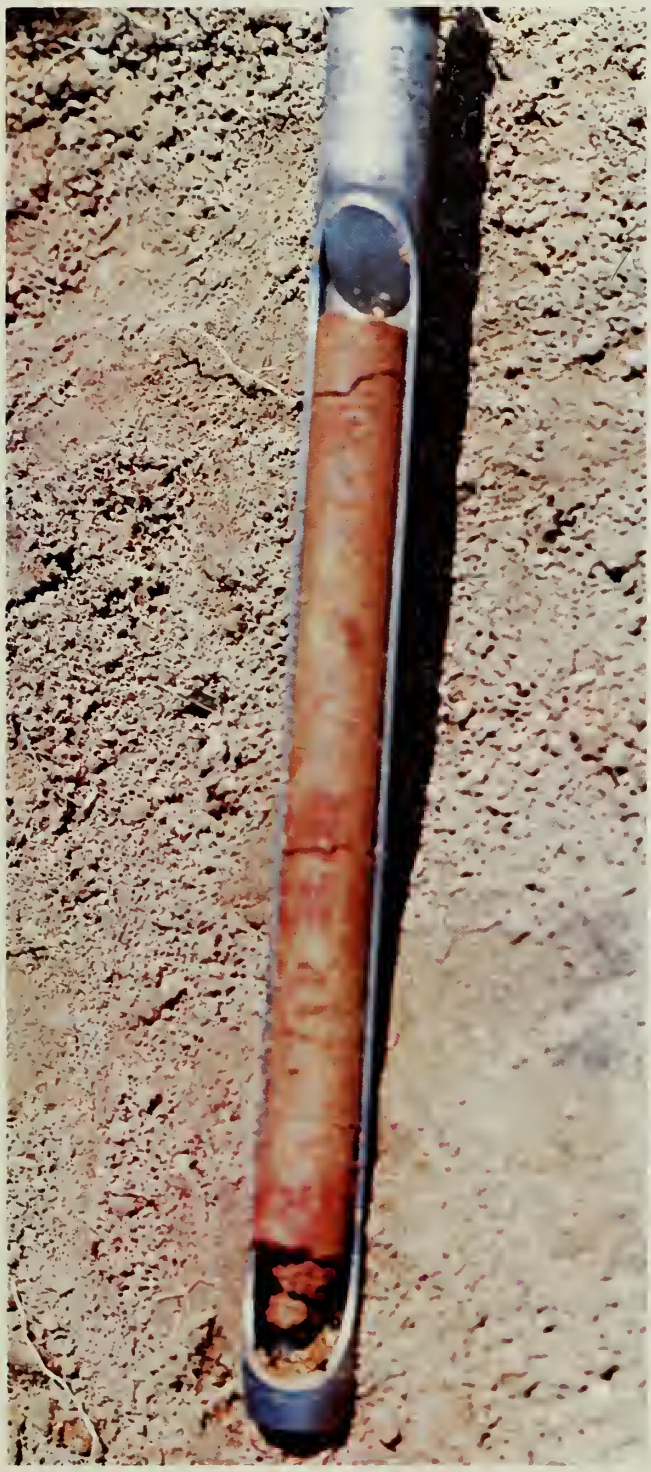
The low hazard Coastal Plain or Piedmont soils are dry; have relatively high clay content within 12 inches of the surface; and typically, the color is reddish rather than yellowish.

Some of the soil series consistently associated with low hazard include: Acadia, Caddo, Malbis, Freestone, Beauregard, and Bladen. While soil series names can be helpful, depth to clay is more important. For example, shallow Ruston soils would be considered low hazard, but when depth to heavier material exceeds 12 inches, they should be considered high hazard.

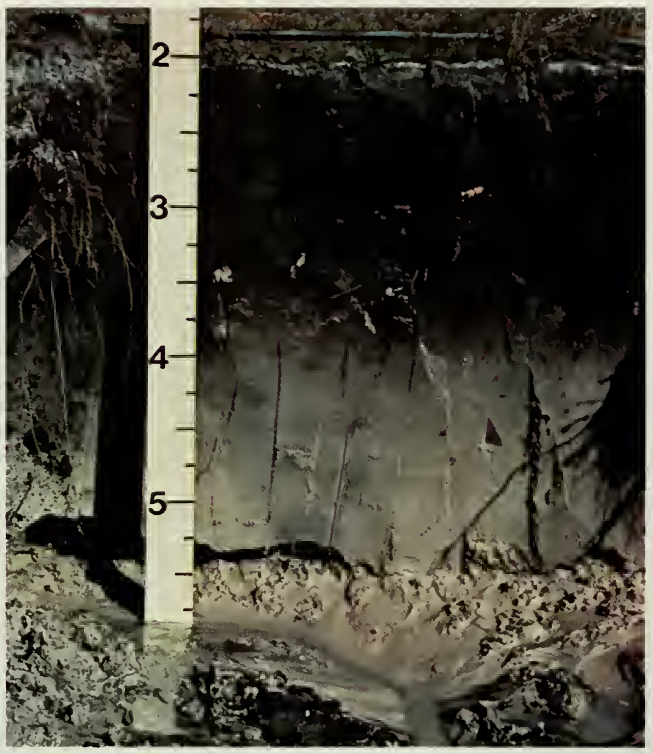
Site quality is not a reliable guide for predicting disease hazard, although poor quality wet sites always can be regarded as low hazard. Low quality dry sites probably can be considered low hazard when poor tree survival and growth result in diminished root contact between residual trees in the stands. Good to excellent site quality may be associated with either low or high hazard sites.

Pitcher plants, crayfish mounds, and gallberry are indicators of low hazard conditions.

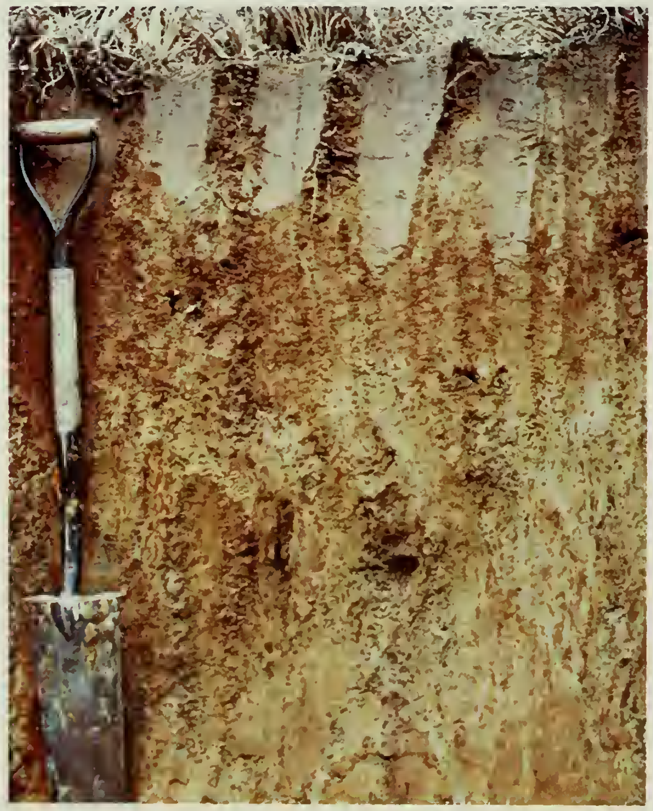
Lowest hazard sites are poorly drained. Water stands in depressions for long periods after rain.



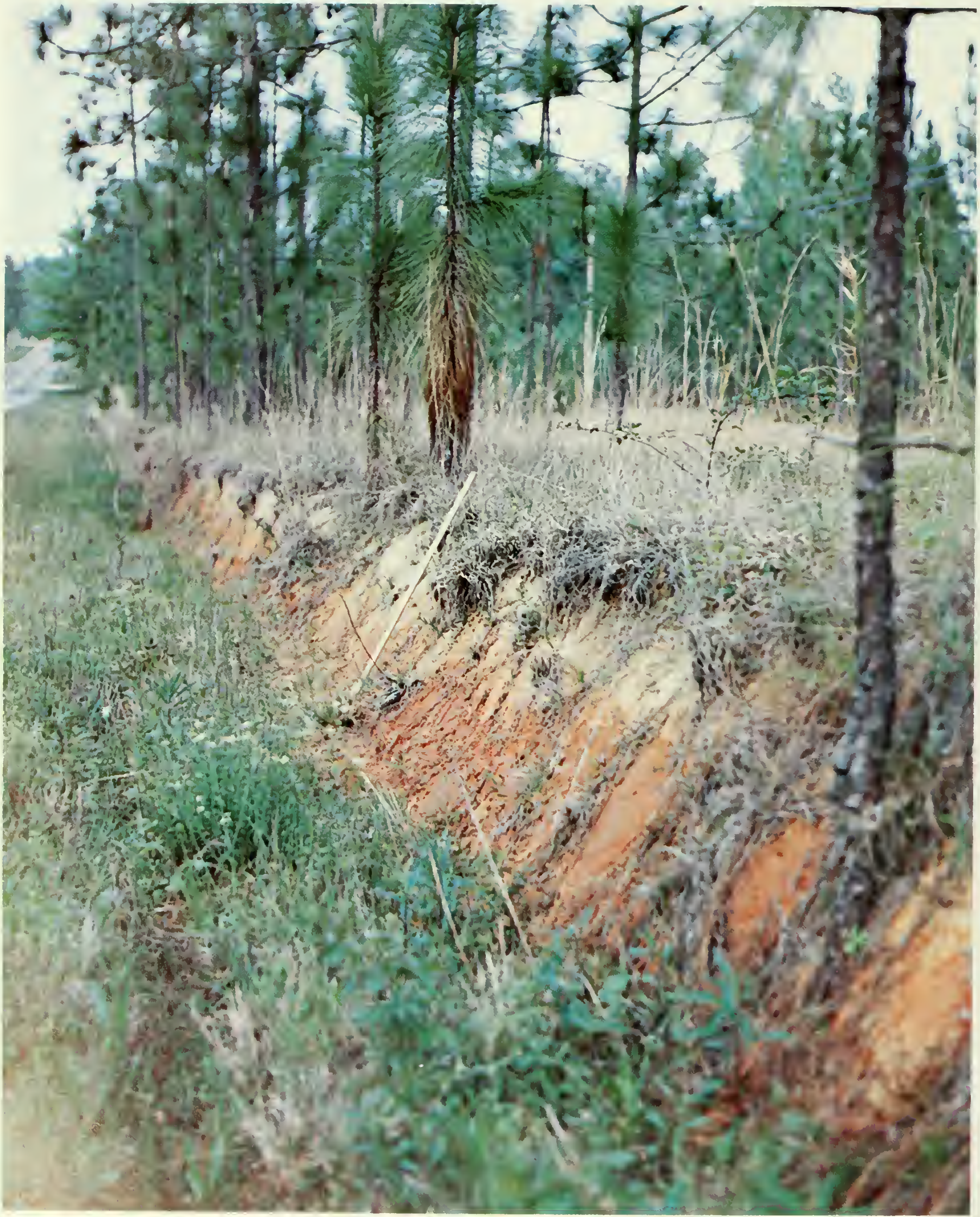
Core sample showing mottled soil.



Some low hazard soils with poor drainage conditions have a dark surface layer with an underlying gray horizon.



Low hazard soils with poor drainage conditions usually are mottled. Mottling even occurs on rolling land with moderate to poor internal drainage.



Sites with moderate to good surface drainage usually are low hazard when heavy clay occurs within about 12 inches of the surface.

High hazard sites.—High hazard sites are those on which serious *F. annosus* damage is likely if preventive measures are not applied.

Generally, heavy damage occurs in counties surrounding Nacogdoches, Texas; in northwest Louisiana near Castor, Minden, and Homer; in the northern one-third of Mississippi, especially around Oxford; on Fort Rucker, Alabama; in southwest Georgia; in the Savannah River Project in South Carolina; and in the sandhills along the Atlantic coast (see map, fig. 2). The disease has been severe in eastern white pine in the Appalachian Mountains. To date, not enough thinning has been done in the relatively poor sandhill sites of west Florida to judge the potential seriousness of the disease for those sites.

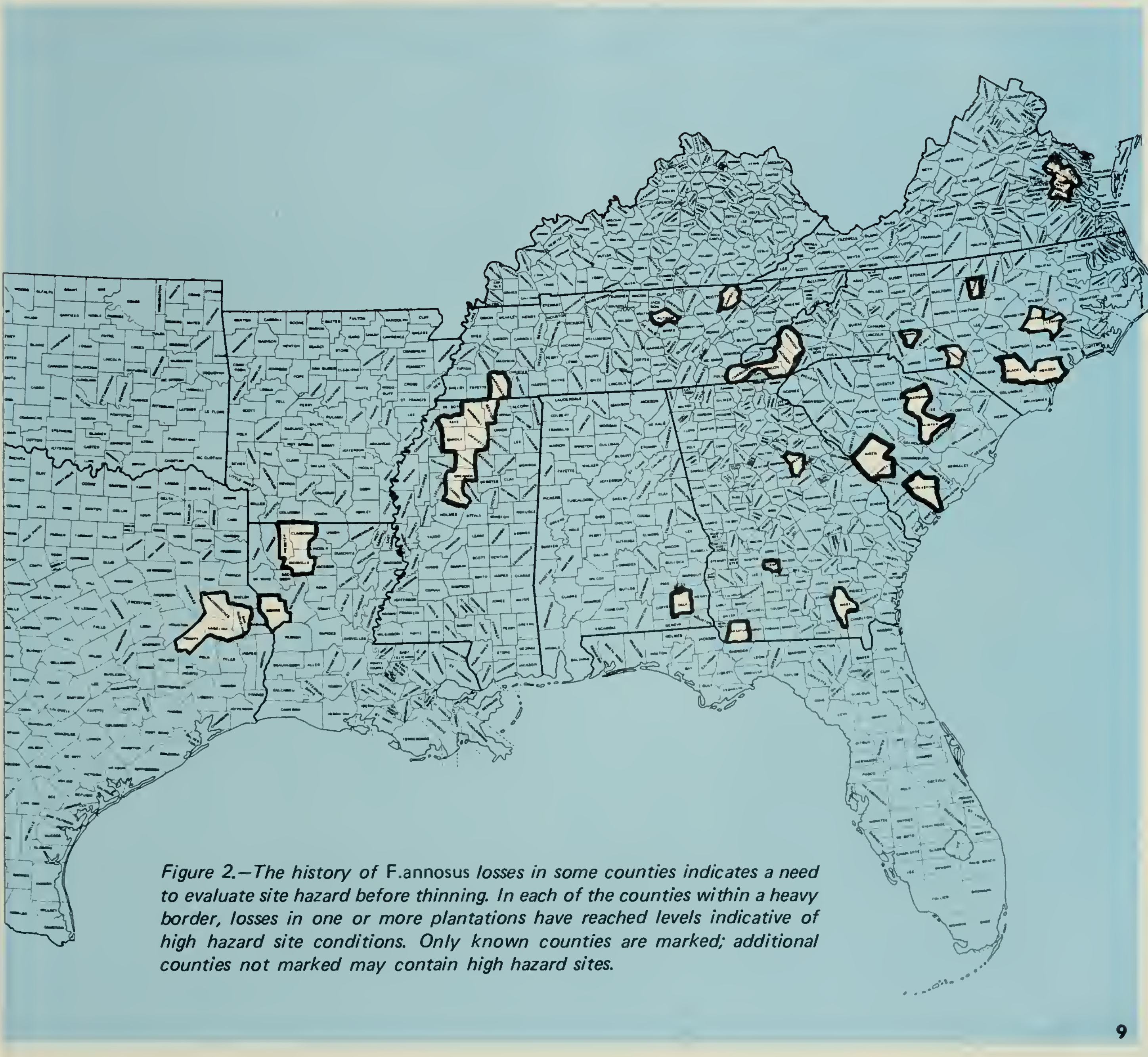


Figure 2.—The history of F.annosus *losses in some counties indicates a need to evaluate site hazard before thinning. In each of the counties within a heavy border, losses in one or more plantations have reached levels indicative of high hazard site conditions. Only known counties are marked; additional counties not marked may contain high hazard sites.*

Although a depth of 12 inches to clay seems to be the approximate breaking point between high and low hazard, *F. annosus* has been a moderate to severe problem in some areas where heavy clay is at or very near the surface. Some of these stands have infection centers of 10 or more dead and dying trees, and it is not unusual to detect more than 30 percent clay in the top 6 inches of soil.

Serious infections have been noted in the following soil series: Eustis, McLaurin, Orangeburg, Lucy, Wagram, Woden, Troup, Linker, Ruston, Benndale, Providence, Memphis, Dulac, Falaya, Durham, and Lakeland. High hazard loamy or clayey soils include Cecil, Loring, Lexington, Musella, and Gwinnett.

Deep sandy soils always should be considered high hazard for F. annosus.

A unique situation exists in north Mississippi where very severe infections also occur on thick, wind-blown, loessial deposits.

How to survey for site hazard.—Areas of high hazard and low hazard often can be identified from published soil survey maps available from the local office of the Soil Conservation Service. The procedure is to study the descriptions of the soil for characteristics of texture and drainage and then interpret the areas on the soil map which are low and high hazard.

In the absence of soil maps, roadside cuts often provide valuable clues about the nature of the soil profile, but systematic evaluations also should be made within representative stands. An inexpensive soil probe can be purchased for that purpose. In hilly terrain, probe enough to establish the proportion of land that is high hazard. It is not necessary to probe deeper than 15 inches or beyond the horizon with considerable clay. When 50 percent or more of the land area is deemed high hazard, the entire stand probably should be managed as though it were high hazard.

A soil probe can be used to examine the soil profile, and evaluate site hazard.

ON HIGH HAZARD SITES — APPLY PREVENTIVE MEASURES

Some preventive measures are warranted in plantations on all high hazard sites, unless experience in an area indicates that infection is restricted to only a few small infection centers per acre. Preventive measures should also be considered in natural stands when conditions and management practices are similar to those in plantations. In high-value stands such as seed production areas, measures are justified even if the sites are classed as low hazard. In economic terms, a high hazard site is one on which losses in the first 5 to 7 years after thinning exceed one cord per acre (15-20 trees). The monetary loss would be approximately double the cost of treating stumps to prevent infection.

Use Borax on Disease-Free Sites

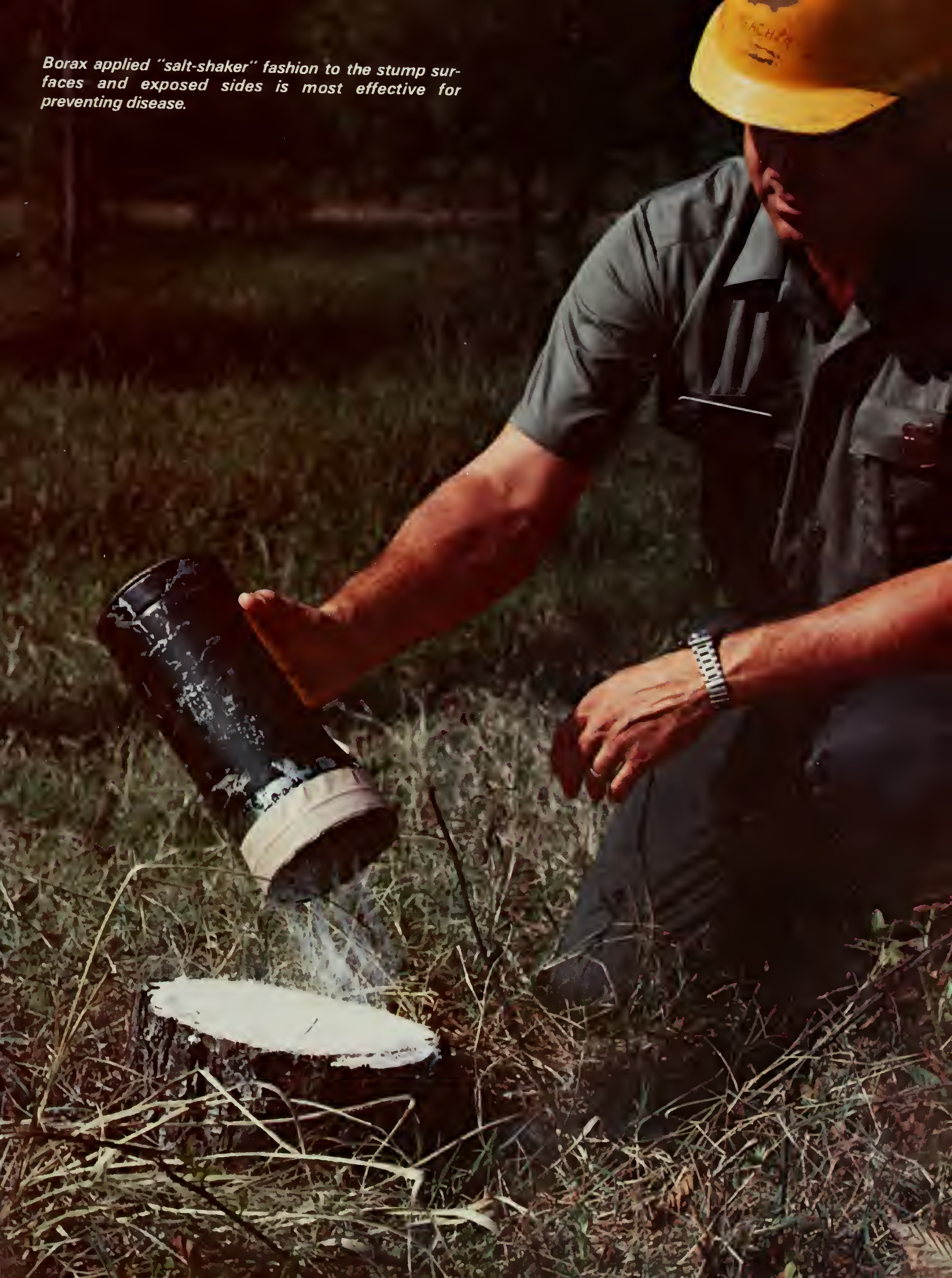
The best method is to coat all exposed wood surfaces with granular, technical grade borax. This should be done immediately after the tree is cut. This fungicide serves as a chemical barrier to wood-destroying organisms such as *F. annosus*. Borax is effective, safe to use, easy to apply, inexpensive, and is not detrimental to the environment. Granular borax will flow freely, even in rainy weather.

If borax is to be applied to stumps by the logger, this should be specified in the logging contract. Some forest managers stipulate a fine for untreated stumps. The addition of a dye or powdered tree marking paint facilitates checking the application. This also will help the worker give a uniform treatment to the entire stump surface and exposed sides. The feller should do the treating. About 5 pounds of chemical would be needed for a thinning that removes 60 square feet of basal area per acre. This is equivalent to 225 7-inch trees. Harvesting time will increase by only 3-5 minutes per cord. It is unlikely that treating stumps will have any noticeable effect on total daily production by a pulpwood crew, especially since many crews routinely work toward daily truckload goals rather than maximum production.

Thin in Summer

May through August is the best time to thin in areas below 34° N latitude. This is because few spores are formed during this period, and high temperatures often kill spores that are produced. No other treatment is necessary if thinning is done during this period, even on high hazard sites. *However, summer thinning in areas of southern pine beetle buildup is not recommended.* Above 34° N latitude, summer thinning may give inconsistent control. Some infections also may occur in summer below 34° N latitude during extensive periods of heavy rainfall and low temperatures.

Borax applied "salt-shaker" fashion to the stump surfaces and exposed sides is most effective for preventing disease.



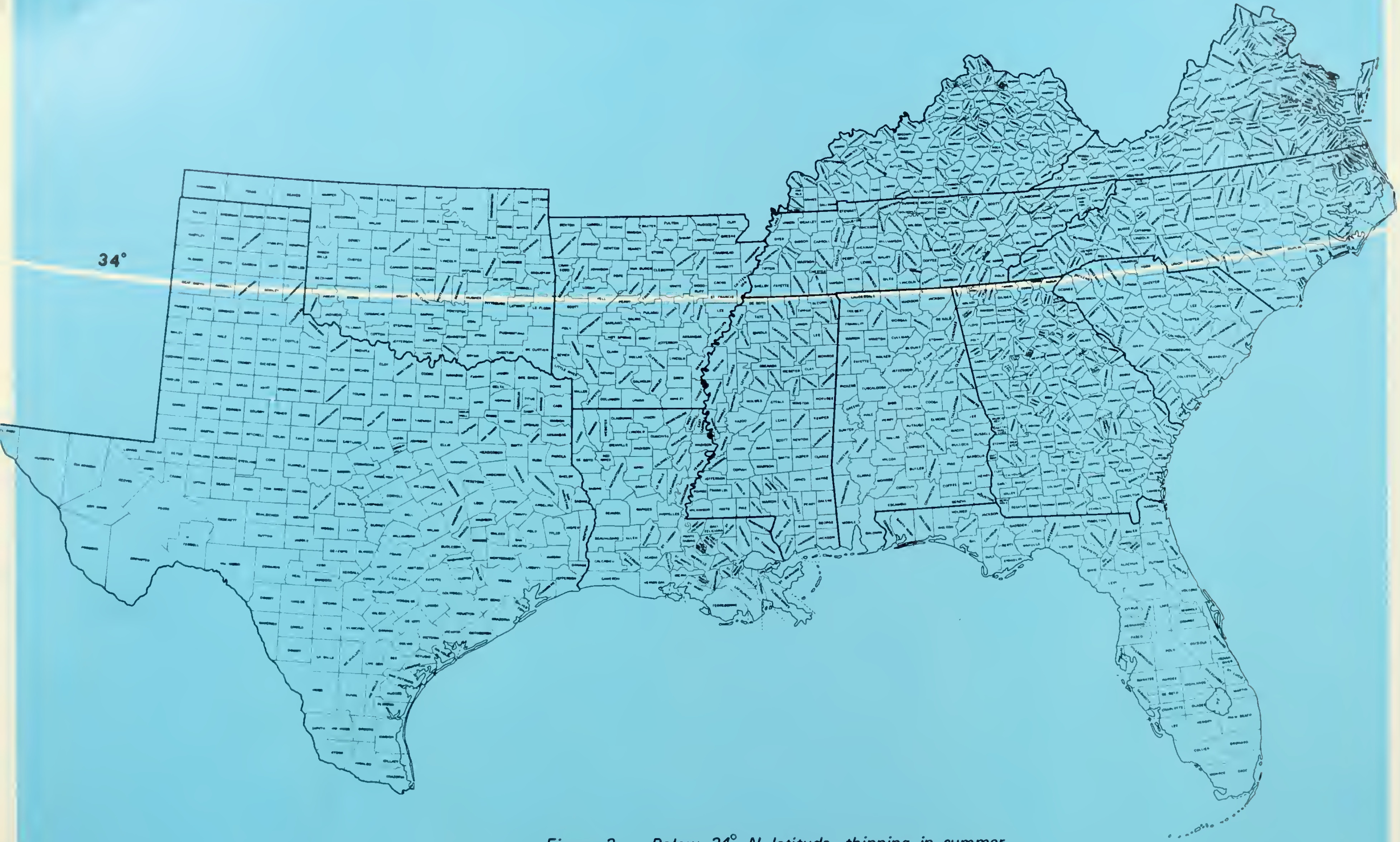
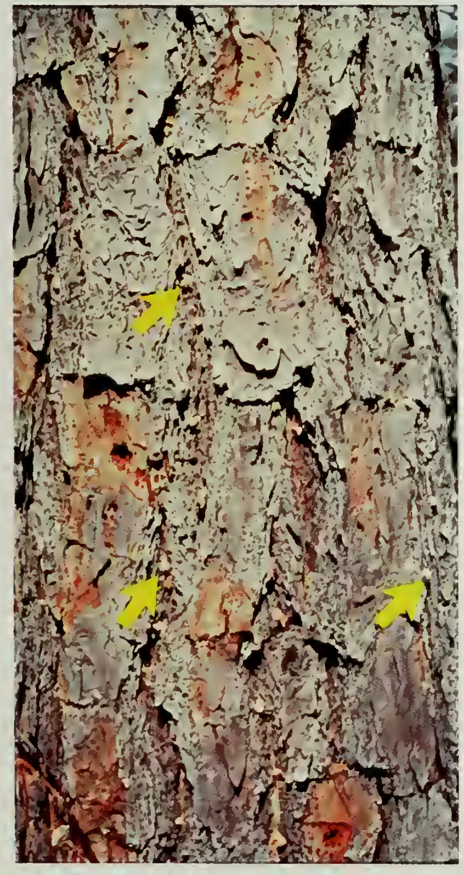


Figure 3 – Below 34° N latitude, thinning in summer (May-August) is usually an effective preventive measure against Fomes annosus. *Above this latitude, summer thinning is ineffective and other preventive measures should be used.*

Other Measures may Help

Prescribe burn high hazard sites.—Although prescribed fire is not as effective as borax in preventing disease, it offers a possible alternative. This is particularly true in cases where the use of borax is not economical and fire is prescribed routinely for other reasons. A program which includes two pre-thinning burns (one in the 6 months preceding) and one or more post-thinning burns may be most effective, but post-thinning burns, alone, are not recommended.

Prescribed fire has an added advantage in that it serves to reduce spore levels by destroying litter usually necessary for development of conks. In constructing fire lines, land managers should not plow excessive numbers of firebacks because infections sometimes originate on severed roots.



Trees weakened by F. annosus *may aggravate bark beetle problems. Yellow pitch tubes are evidence of beetle attack.*

Prescribed burning provides partial control of F. annosus *in many stands.*

Reduce the number of thinnings per rotation.—Frequent thinnings should be avoided on high hazard sites because fresh stumps are prime locations for new stand infections. Numbers of thinnings can be reduced by spacing trees as widely as practical during planting and by thinning more heavily than normal, perhaps reducing basal areas to below 70 square feet per acre. However, additional stumps may result in increased infection unless borax is applied. Elimination of thinnings altogether would be an ideal way to prevent disease, and this may be practical on some short rotation pulpwood situations.

Use a biological control on diseased sites,—When applied immediately to all cut surfaces, borax should be effective on all sites that are free of *F. annosus.* However, in infected stands, borax may serve to aggravate the problem by preventing natural competitors from entering the stump.

A competing fungus, *Peniophora gigantea,* is effective against *F. annosus* and is especially recommended for second thinnings to inhibit further spread of the disease. One culture plate of *P. gigantea* available commercially from BioBasic, P.O. Box 5668, Raleigh, North Carolina 27607, will make 4 gallons of spore suspension, enough to treat about 500 10-inch stumps, or the harvest of 25 cords of wood. Two to 4 cubic centimeters are required to wet the entire stump surface. A fresh suspension must be prepared daily.

Use P. gigantea, *a competing fungus, instead of borax whenever thinning infected stands.* P. gigantea *may be applied with a plastic squeeze bottle or a garden sprayer.*

Consider planting longleaf pine on some sites.—All of the major pines in the South are attacked by *F. annosus,* but longleaf pine seems to be the least susceptible. Longleaf, therefore, may be preferred on sandy, high hazard sites.

HEAVILY INFECTED STANDS — WHAT TO DO

As a rule, stands in which dead and infected trees exceed 20 percent in the first 5 years after thinning should not be carried to rotation. However, an immediate final harvest cut may not be necessary if trees are expected to grow from pulpwood to sawlog size in a matter of just a few years. The stumpage value of sawlogs may be five times that of pulpwood and would outweigh losses due to the disease in this situation. After the final harvest cut, stands may be regenerated immediately even though seedling losses of 1-5 percent may occur. The disease may be expected to run its course before root contacts are made between trees of the new crop.

Trade names are used in this publication solely to provide specific information. Mention of a trade name does not constitute a warranty of the product by the U.S. Department of Agriculture or an endorsement by the Department over other products not mentioned.

If pesticides are handled, applied, or disposed of improperly, they may be injurious to humans, domestic animals, desirable plants, and pollinating insects, fish, or other wildlife, and may contaminate water supplies. Use pesticides only when needed and handle them with care. Follow the directions and heed all precautions on the container label.

Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your county agricultural agent or State extension specialist to be sure intended use is still registered. [Since *P. gigantea* is a naturally occurring organism in southern pine forests, cultures of the organism are not considered a pesticide under the Federal Insecticide, Fungicide, and Rodenticide Act, as amended; and therefore, this organism when used as an inoculum on freshly cut stumps does not require registration. Ref. E.P.A. ruling April 30, 1976.]

For additional information contact your State Forestry Organization
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